



LA7953

Audio Controller for TV Use

Overview

The LA7953 Audio Controller is a single-chip, liner IC featuring a built-in expansion circuit. The device also features a 4-input 1-output audio switch, an acoustic mute, a LINE-OUT output, and audio control functions for volume, balance, bass and treble on-chip.

Excellent audio reproduction can be obtained using the right channel expansion circuit.

The LA7953 operates on a single 12V power supply and is available in 30-pin plastic DIPs.

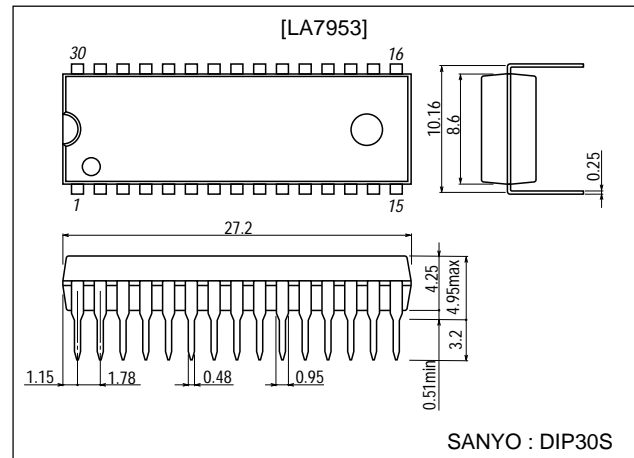
Features

- On-chip audio controller and audio switch facilitate design.
- Audio controller for volume, balance, bass and treble.
- 4-input/1-output audio switch.
- On-chip expansion circuit ensures excellent sound reproduction.
- LINE-OUT output.
- Acoustic mute.

Package Dimensions

unit:mm

3061-DIP30S



Specifications

Maximum Ratings at Ta = 25°C

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V _{CC} max		14	V
Input applied voltage 1	V _{1, 3, 5, 7, 9, 11, 13, 15} max	V _{CC} =14V	12	V
Input applied voltage 2	V _{2, 14, 16, 30} max	V _{CC} =14V	14	V
Input applied voltage 3	V ₄ max, V ₆ max	V _{CC} =14V	14	V
Mute input applied voltage	V ₈ max	V _{CC} =14V	14	V
Expansion input applied voltage	V ₁₂ max	V _{CC} =14V	14	V
LINE-OUT output current	I _{17, 29} max		5	mA
Maximum output current	I _{23, 25} max		5	mA
Expansion output current	I ₁₉ max		5	mA
Tone control input applied voltage	V ₂₀ max, V ₂₈ max	V _{CC} =14V	14	V
Bass filter applied voltage	V ₂₂ max, V ₂₆ max	V _{CC} =14V	14	V
Treble filter applied voltage	V ₂₁ max, V ₂₇ max	V _{CC} =14V	14	V

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Parameter	Symbol	Conditions	Ratings	Unit
Expansion filter applied voltage	V_{18} max	$V_{CC}=14V$	12	V
Allowable power dissipation	P_d max	$T_a \leq 65^\circ C$	1100	mW
Operating temperature	T_{opr}		-20 to +65	$^\circ C$
Storage temperature	T_{stg}		-55 to +150	$^\circ C$

Operating Conditions at $T_a = 25^\circ C$

Parameter	Symbol	Conditions	Ratings	Unit
Recommended supply voltage	V_{CC}		12	V
Operating voltage range	V_{CC} op		10.5 to 13.2	V

Operating Characteristics at $T_a = 25^\circ C$, $V_{CC}=12V$

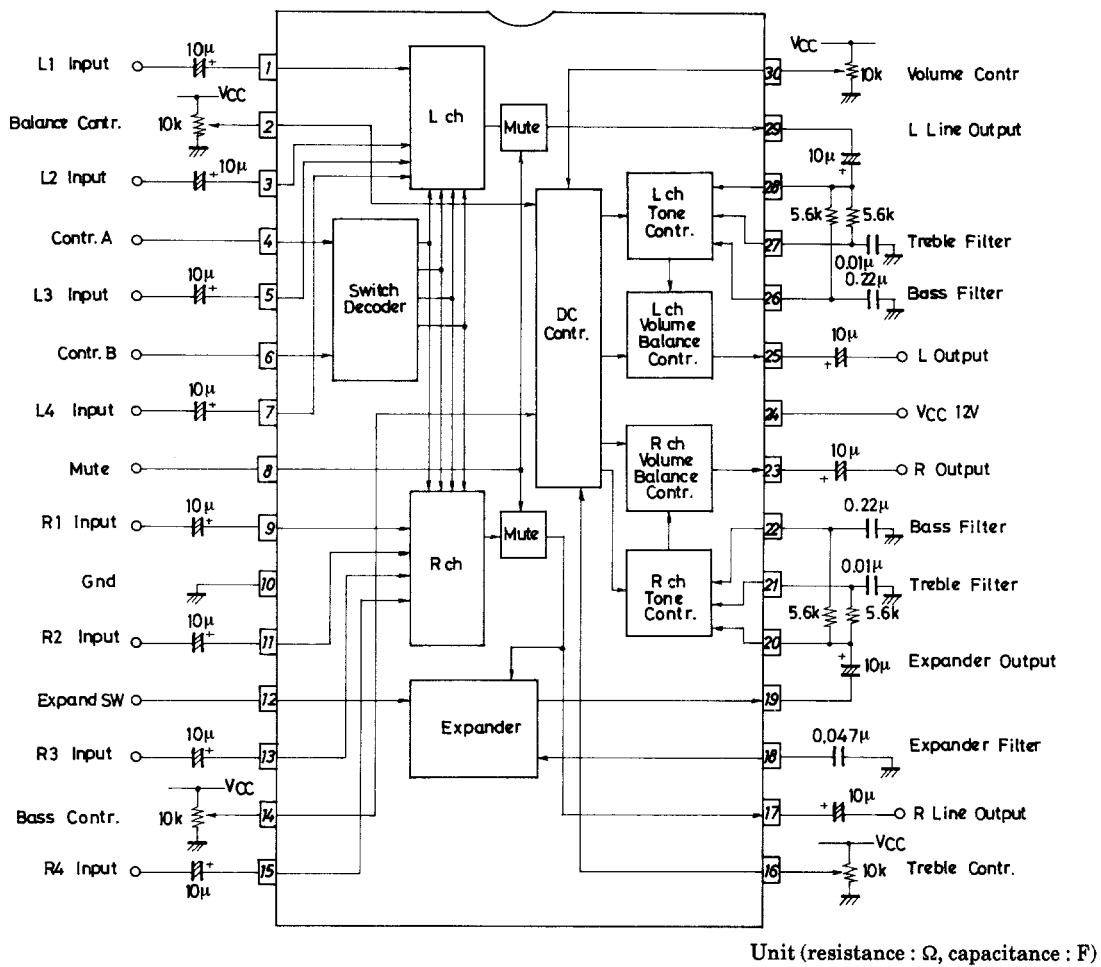
Parameter	Symbol	Conditions	Test Circuit	Ratings			Unit
				min	typ	max	
[Audio SW]							
Input bias voltage	$V_{1, 3, 5, 7, 9, 11, 13, 15}$		1	4.4	5.3	6.2	V
LINE-OUT output bias voltage	$V_{17, 29}$	S4, S5=H	1	2.1	3.0	3.9	V
LINE-OUT output DC offset voltage	V_{OS}	Differential voltage when LINE-OUT output is switched.	1	-100	0	+100	mV
Control threshold voltage	V_{4H}, V_{6H}		2	3.0			V
Control threshold voltage	V_{4L}, V_{6L}		2			1.5	V
LINE-OUT voltage gain	G_{LV}	$V_{IN}=500mV_{rms}$, $f=1kHz$	2	-1	0	+1	dB
LINE-OUT distortion ratio	THD_L	$V_{IN}=500mV_{rms}$, $f=100Hz, 1kHz$, L.P.F=80kHz	2		0.05	0.2	%
LINE-OUT noise	V_{NL}	$R_g=600\Omega$, 15kHz band	2		10	30	μV_{rms}
Mute input threshold voltage	V_{8TH}		2	3.0			V
Mute input threshold voltage	V_{8TL}					1.5	V
Input impedance	$Z_{1, 3, 5, 7, 9, 11, 13, 15}$		1	47	68	89	k Ω
LINE-OUT output impedance	$Z_{17, 29}$		1		50	150	Ω
[Audio Control]							
Quiescent current drain (including audio switch)	I_{CC}		1	35	45	65	mA
Output bias voltage	V_{23}, V_{25}	$V_{30}=12V$, $V_2=V_{14}=V_{16}=6V$	1	4	5.5	7	V
Left & right channel output DC offset	V_{23} to V_{25}	$V_{30}=12V$, $V_2=V_{14}=V_{16}=6V$	1	-2	+0.2	+2	V
Output voltage	V_O	$V_{IN}=500mV_{rms}$, $f=1kHz$, $V_{30}=12V$, $V_2=V_{14}=V_{16}=6V$	2	390	450	630	mV $_{rms}$
Channel balance	C_{Ba}	$V_{IN}=500mV_{rms}$, $f=1kHz$, $V_{30}=12V$, $V_2=V_{14}=V_{16}=6V$	2	-1	+0.4	+1	dB
Dynamic range	THD_D	$V_{IN}=0.8mV_{rms}$, $f=40Hz, 15kHz$, L.P.F=80kHz, $V_{30}=12V$, $V_2=V_{14}=V_{16}=6V$	2		0.25	2	%
Left & right channel attenuation	ATT	$V_{OUT}=500mV_{rms}$ (0dB), $f=1kHz$, $V_{30}=0V$, $V_2=V_{14}=V_{16}=6V$	2	65	72		dB
Bass control, boost	GB_{BOOST}	$V_{OUT}=500mV_{rms}$ (1k), $f=40Hz$, $V_{30}=V_{14}=12V$, $V_2=V_{16}=6V$	2	7	9	12	dB
Bass control, cut	GB_{CUT}	$V_{OUT}=500mV_{rms}$ (1k), $f=40Hz$, $V_{30}=12V$, $V_{14}=0V$, $V_2=V_{16}=6V$	2	-1.3	-9	-6.5	dB
Treble control, boost	GB_{BOOST}	$V_{OUT}=500mV_{rms}$ (1k), $f=15kHz$, $V_{30}=V_{11}=12V$, $V_2=V_{14}=6V$	2	6.5	9	13	dB
Treble control, cut	GT_{CUT}	$V_{OUT}=500mV_{rms}$ (1k), $f=15kHz$, $V_{30}=12V$, $V_{14}=0V$, $V_2=V_{16}=6V$	2	-18	-9	-6.5	dB
Balance control	ATT_{BR}	$V_{OUT}=500mV_{rms}$ (0dB), $f=1kHz$, $V_{30}=12V$, $V_2=0V$, $V_{14}=V_{16}=6V$	2		-55	-40	dB
Balance control	ATT_{BL}	$V_{OUT}=500mV_{rms}$ (0dB), $f=1kHz$, $V_{30}=V_2=12V$, $V_{14}=V_{16}=6V$	2		-55	-40	dB
Crosstalk	CT	$V_{OUT}=500mV_{rms}$ (0dB), $f=1kHz$, $V_{30}=12V$, $V_2=V_{14}=V_{16}=6V$	2	65	80		dB
Noise	V_N	15kHz band, $V_{30}=12V$, $V_2=V_{14}=V_{16}=6V$	2		80	240	μV_{rms}
Total harmonic distortion	THD	$V_{IN}=500mV_{rms}$, $f=1kHz$, L.P.F=80kHz, $V_{30}=12V$, $V_2=V_{14}=V_{16}=6V$	2		0.2	0.5	%
Expansion characteristics	P_{EXP}	$V_{IN}=500mV_{rms}$, $f=1kHz$, $C=0.047\mu$, $V_{30}=12V$, $V_2=V_{14}=V_{16}=6V$	2	125	145	165	$^\circ C$
Expansion characteristics	G_{EXP}	$V_{IN}=500mV_{rms}$, $f=1kHz$, $C=0.047\mu$, $V_{30}=12V$, $V_2=V_{14}=V_{16}=6V$	2	-1	0	+1	dB
Expansion control threshold voltage	V_{EXPH}		2	3.0			V
Expansion control threshold voltage	V_{EXPL}		2			1.5	V
Left & right channel output impedance	Z_{LR}		1		150	300	Ω

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Audio Switch Truth Table

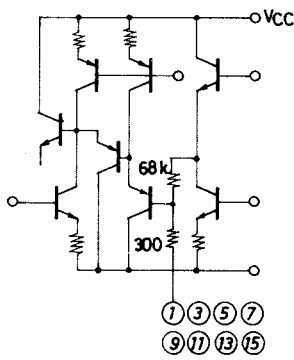
S4 (Pin 4)	S5 (Pin 6)	L1 (Pin 1)	L2 (Pin 3)	L3 (Pin 5)	L4 (Pin 7)	R1 (Pin 9)	R2 (Pin 11)	R3 (Pin 13)	R4 (Pin 15)
H	H	ON	OFF	OFF	OFF	ON	OFF	OFF	OFF
L	H	OFF	ON	OFF	OFF	OFF	ON	OFF	OFF
H	L	OFF	OFF	ON	OFF	OFF	OFF	ON	OFF
L	L	OFF	OFF	OFF	ON	OFF	OFF	OFF	ON

Equivalent Circuit Block Diagram

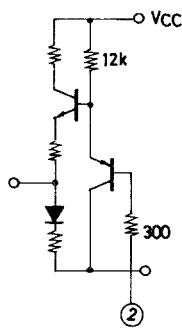


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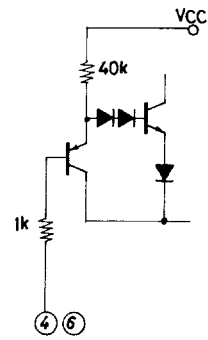
I/O Equivalent Circuits



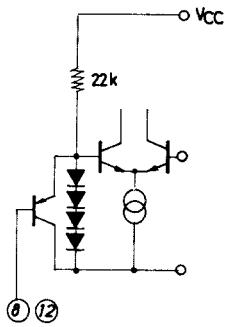
R, L Input



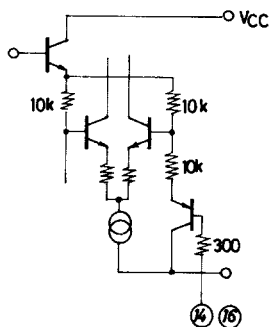
Balance Contr.



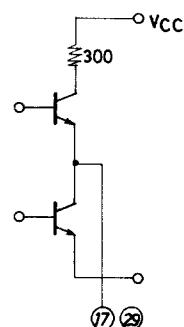
Contr. A, B



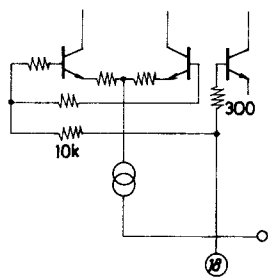
Mute, Expand SW



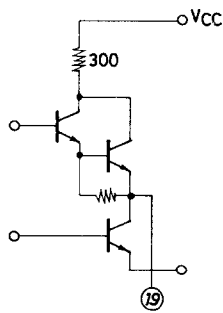
Bass, Treble Contr.



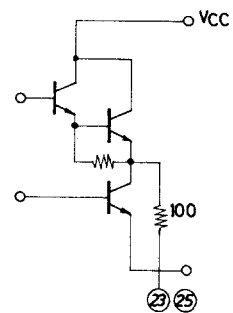
R, L Line Output



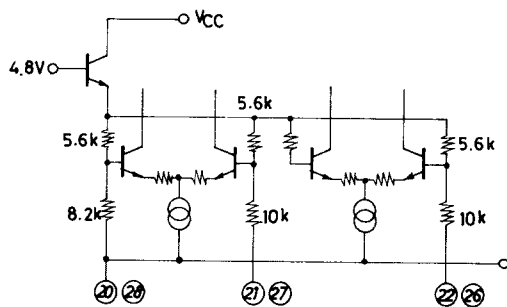
Expander Filter



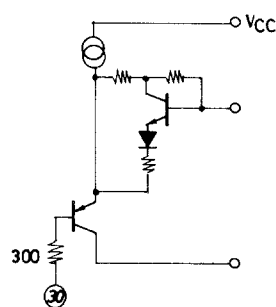
Expander Output



R, L Output



Treble, Bass Filter

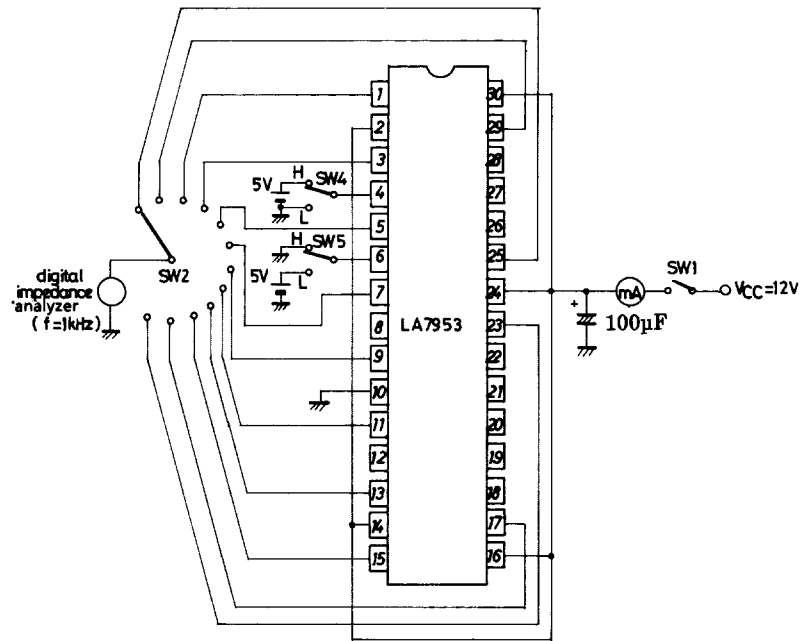


Volume Contr.

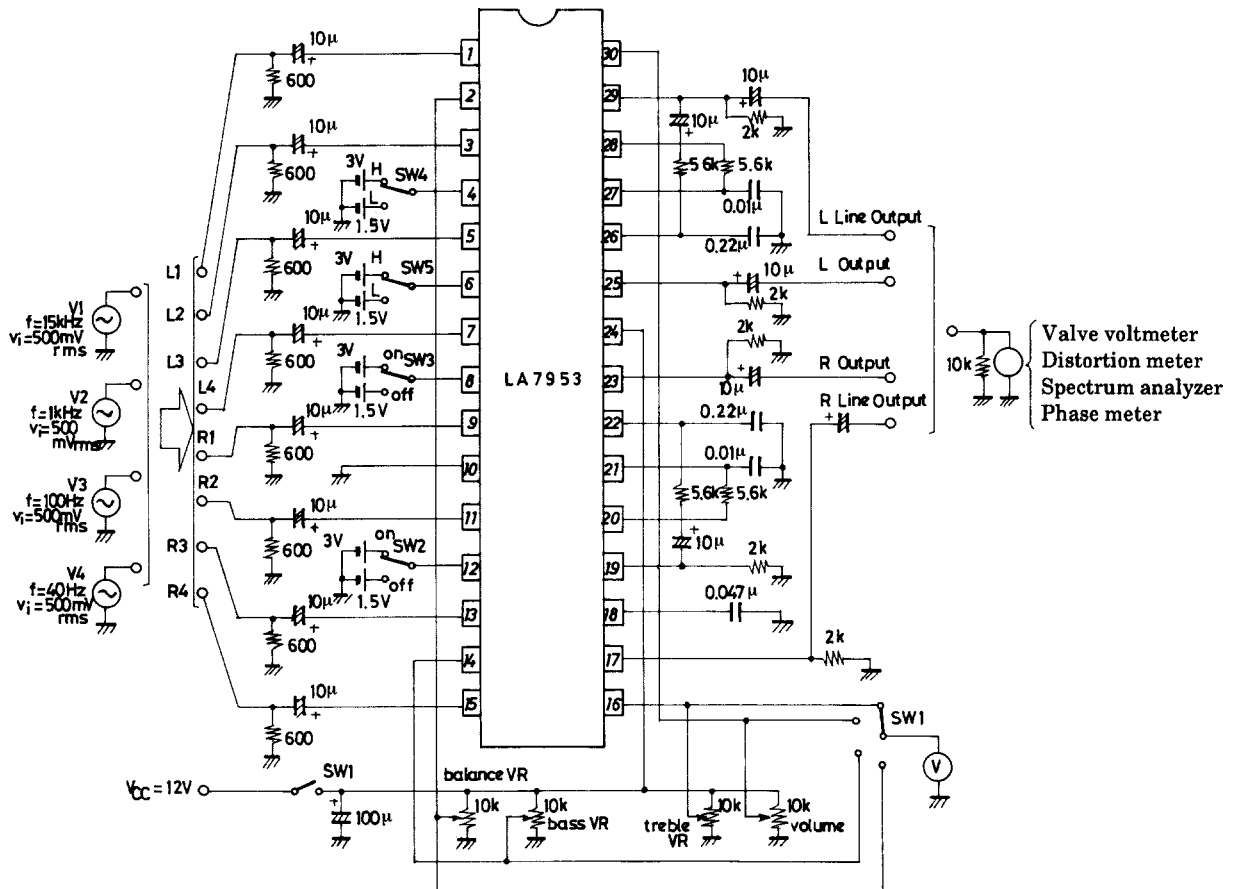
Unit (resistance : Ω)

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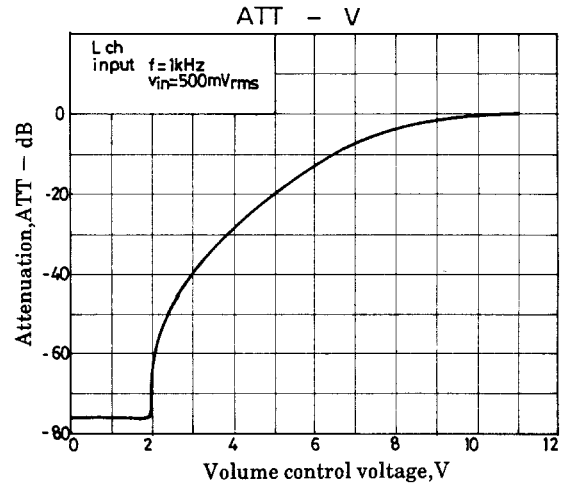
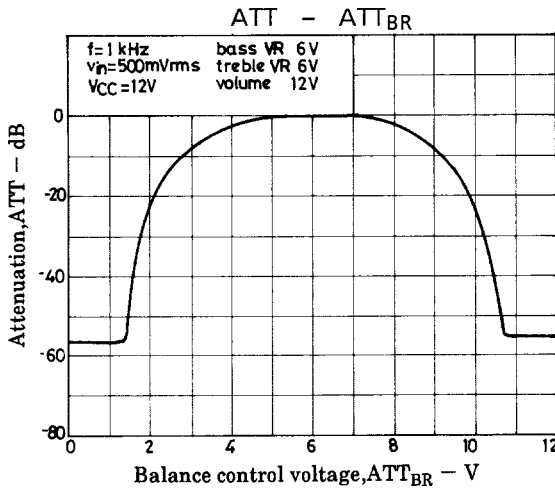
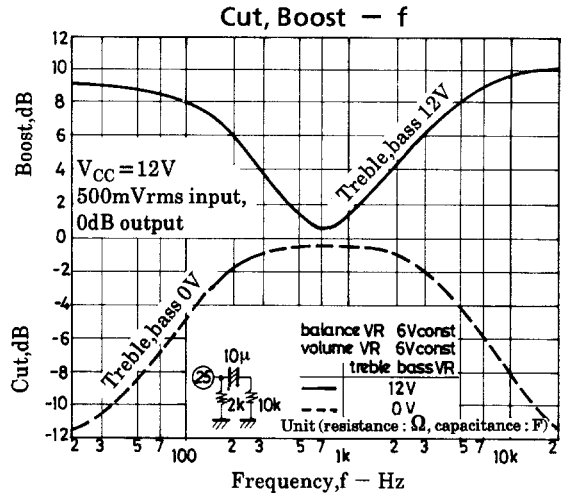
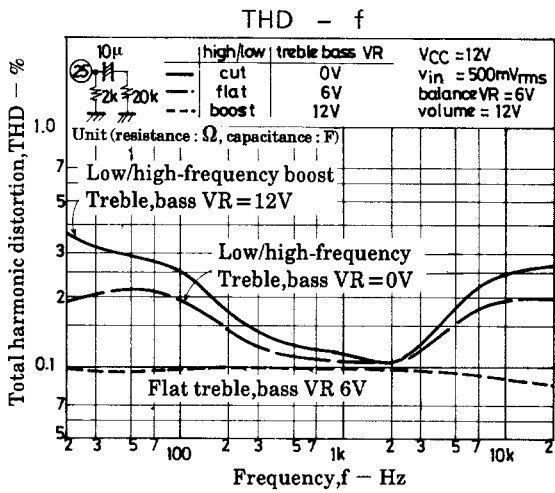
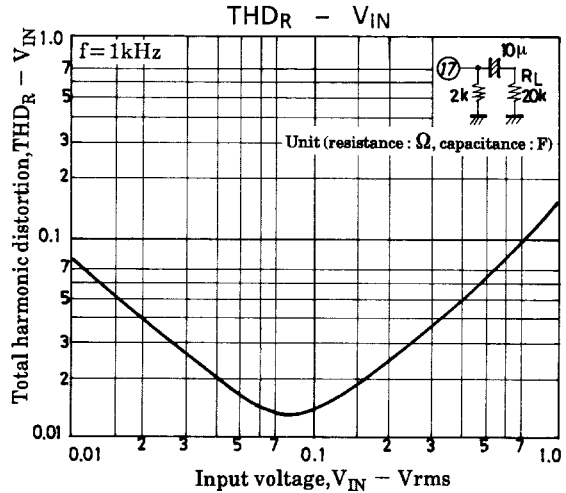
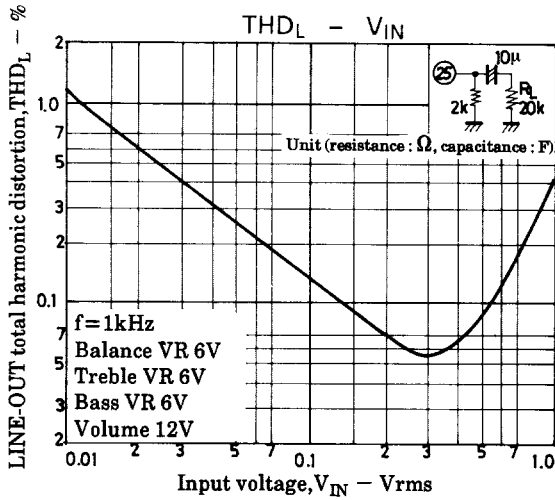
Test Circuit (1)



Test Circuit (2)



Unit (resistance : Ω, capacitance : F)



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